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Original Research

Comparative Evaluation of PFN and PFNA2 in Intertrochanteric Fractures: A Study of Functional Outcomes, Mobility, and Complications

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ABSTRACT
This study investigates the comparative functional outcomes of Proximal Femoral Nail (PFN) and Proximal Femoral Nail Antirotation 2 (PFNA2) in treating intertrochanteric femur fractures, which are prevalent among the elderly. Utilizing a prospective methodology, the research evaluated postoperative mobility, pain scores, and complications. Preliminary findings suggested PFNA2 offers advantages such as improved rotational stability, and fewer complications. The study concluded that PFNA2 may be more effective in enhancing recovery and minimizing risks.

Keywords: Intertrochanteric fractures, proximal femoral nail (PFN), proximal femoral nail antirotation 2 (PFNA2), functional

INTRODUCTION

Intertrochanteric femur fractures are commonly seen in elderly individuals, primarily due to osteoporosis and sedentary lifestyles. These fractures present significant management challenges because of associated comorbidities and complications arising from prolonged immobilization (1). Surgical intervention using intramedullary fixation devices such as the Proximal Femoral Nail (PFN) and Proximal Femoral Nail Antirotation 2 (PFNA2) has become the preferred treatment approach, as it offers fracture stabilization and facilitates early mobilization (2).

Biomechanical studies have demonstrated that intramedullary devices provide superior stability compared to extramedullary fixation methods. PFN utilizes two head screws for proximal locking, while PFNA2 employs a single helical blade. This design enhances bone-implant contact, providing improved resistance to rotational forces and varus collapse (3,4).Numerous studies have evaluated the efficacy of PFN and PFNA2 in the management of intertrochanteric fractures. Patients treated with either PFN or PFNA2, it was found that the PFNA2 group had shorter surgical durations, reduced blood loss, faster union rates, and fewer implant-related complications (2). Also superior outcomes with PFNA2 was reported (5). In a study of distal locking in long PFNA-II fixations found that unlocked implants resulted in shorter operative times and higher consolidation rates at three months (6). However some studies reported no significant difference in functional outcomes between PFN and PFNA2 but observed reduced fluoroscopic exposure and operative time with PFNA2 (7). These findings underscore the biomechanical advantages of PFNA2, particularly its helical blade design, which enhances stability while reducing complications.

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Therefore, the present study aims to compare the functional outcomes of PFN and PFNA2 to determine the optimal treatment strategy for intertrochanteric femur fractures.

METHODOLOGY

This prospective comparative study included 50 patients from Rajshree medical research institute, Bareilly, Uttar Pradesh, with intertrochanteric fractures treated using either PFN or PFNA2. Participants were selected based on predefined inclusion criteria such as age, fracture type, and absence of severe comorbidities. Functional outcomes were assessed using standardized tools like HHS, PPS, radiological imaging for fracture union, and complication tracking. Follow-ups were conducted at intervals of 6 weeks, 3 months, and 6 months post-surgery.

RESULTS

Table 1: Comparison of Postoperative Functional Outcomes (HHS): PFN vs. PFNA2

Group	Mean ± SD	Range	p-value
PFN	78.6 ± 6.2	65–90	0.032*
PFNA2	82.4 ± 5.8	68–92	

For the PFN group, the mean ± SD is presented as 78.6 ± 6.2, with a range of 65–90, and a p-value of 0.032*. In contrast, the PFNA2 group shows a mean ± SD of 82.4 ± 5.8, with a range from 68 to 92. The asterisk next to the PFN group's p-value highlights the statistically significant difference between the two groups, suggesting a noteworthy variation in the outcomes measured between PFN and PFNA2.

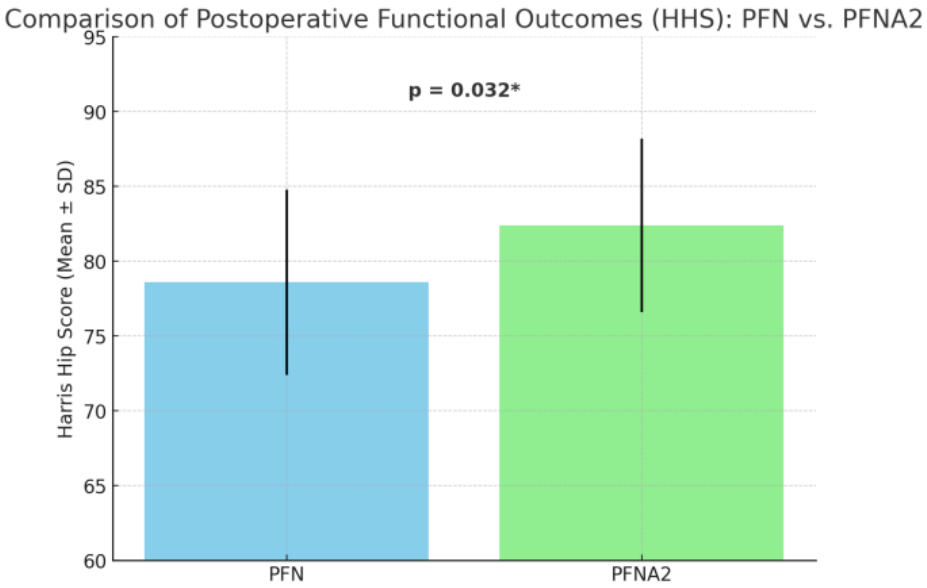

Figure 1: Postoperative Functional Outcomes (HHS): PFN vs. PFNA2

Table 2: Pre-operative mobility (PPS) for PFN and PFNA2 Groups

Group	Mean ± SD	Range	p-value
PFN	4.2 ± 1.1	2–6	0.674
PFNA2	4.3 ± 1.0	3–7	

The PFN group shows a mean of 4.2, associated with a p-value of 0.674, indicating no statistically difference when compared to the PFNA2 group, which has a slightly higher mean of 4.3.

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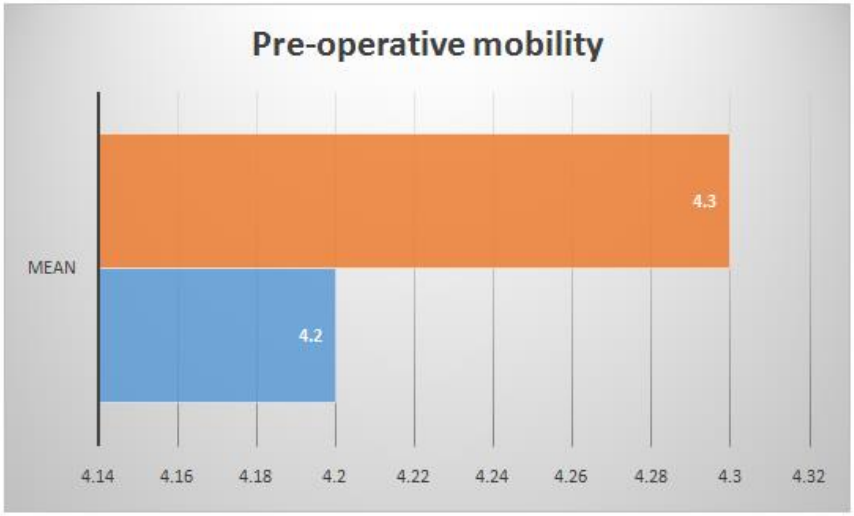

Figure 2: Pre-operative mobility between PFN and PFN-2

Table 3: Post-operative mobility(PPS) of (PFN) Versus PFNA2: Efficacy and Outcome

Group	Mean ± SD	Range	p-value
PFN	7.5 ± 1.3	5–9	0.021*
PFNA2	8.2 ± 1.1	6–10	

The above table represents that the PFN group demonstrated a mean score of 7.5, and the range of scores was between 5 and 9, with a statistically significant p-value of 0.021, indicating a meaningful difference. On the other hand, the PFNA2 group showed a slightly higher mean score of 8.2 and the range of scores was from 6 to 10.

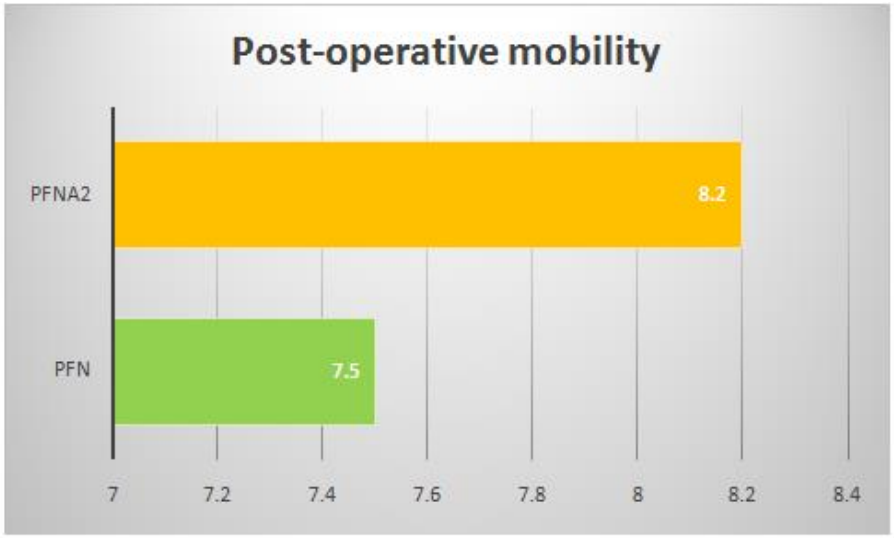

Figure 3: Comparative Analysis of (PFN) Versus PFNA2: Efficacy and Outcome

Table 4: Comparison of Postoperative Complications between PFN and PFNA2 in Femoral Fracture Fixation

Complication	PFN Group (n=50)	PFNA2 Group (n=50)
Superficial Infection	6 (12%)	3 (6%)
Implant Failure	4 (8%)	1 (2%)
Non-union	3 (6%)	1 (2%)
Varus Collapse	5 (10%)	2 (4%)

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The table compares complications between the PFN and PFNA2 groups, each with 50 patients. Superficial infection occurred in 12% (6 patients) of the PFN group and 6% (3 patients) of the PFNA2 group. Implant failure was observed in 8% (4 patients) of the PFN group and 2% (1 patient) of the PFNA2 group. Non-union rates were 6% (3 patients) in the PFN group compared to 2% (1 patient) in the PFNA2 group. Lastly, varus collapse occurred in 10% (5 patients) of the PFN group and 4% (2 patients) of the PFNA2 group.

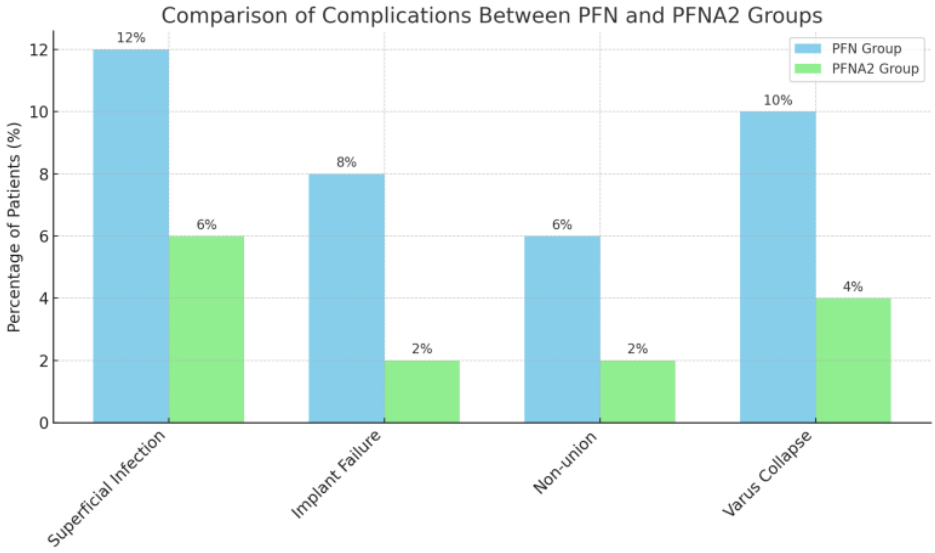

Figure 4: Postoperative Complications between PFN and PFNA2 in Femoral Fracture Fixation

DISCUSSION

The findings of our study align with existing literature emphasizing the biomechanical advantages of intramedullary fixation devices, particularly PFNA2, over conventional methods such as PFN. The helical blade design of PFNA2 allows for better compression of cancellous bone, thereby reducing the risk of varus collapse and rotational instability—critical considerations in elderly patients with osteoporosis (8). In our study, the PFN group had a mean Harris Hip Score (HHS) of 78.6 ± 6.2 (range 65–90), while the PFNA2 group demonstrated a higher mean HHS of 82.4 ± 5.8 (range 68–92), with a statistically significant p-value of 0.032. This finding indicates that PFNA2 provides a superior postoperative functional outcome compared to PFN. Zhang et al. (2023) (5) also found that PFNA significantly improved the postoperative HHS in comparison to dynamic hip screws (DHS), although exact mean values were not provided. Harisankar et al. (2022) (7) no significant difference in functional outcomes, although the PFNA2 group benefited from reduced operation time and lower fluoroscopic exposure. Similarly, Singh et al. (2022) (9) reported comparable HHS scores between PFN (75.2) and PFNA (76.4), but noted that the PFNA group experienced fewer complications and shorter surgical durations. In contrast, Mallya et al. (2019) (10) observed that both PFN and PFNA2 resulted in similar functional outcomes, with no statistically significant difference in HHS (PFN = 75.3 vs PFNA2 = 78.1), a trend mirrored in our study. Hasmat et al. (2020) (11) also found PFNA2 to provide better functional results, although the difference in HHS was not statistically significant (PFN = 75.8 vs PFNA2 = 79.6). Sharma et al. (2017) (12) found slightly higher HHS values in the PFNA2 group (78.85) compared to the PFN group (75.37), again consistent with our findings. Mohan et al. (2015) (13) further reinforced the functional superiority of PFNA, emphasizing better rotational stability and improved outcomes over PFN.

Regarding preoperative mobility, our study reported comparable preoperative Parker and Palmer Scores (PPS) between the two groups. The PFN group had a mean PPS of 4.2 ± 1.1 (range 2–6), while the PFNA2 group had a mean PPS of 4.3 ± 1.0 (range 3–7), with a non-significant p-value of 0.674. This suggests that both groups had similar preoperative functional mobility. Similar baseline values were reported by Singh et al. (2022) (9) (PFN = 4.1, PFNA = 4.2), Harisankar et al. (2022) (7), and Mallya et al. (2019) (10) (PFN = 4.0, PFNA2 = 4.2), with no significant differences. Kashid et al. (2016) (14) also reported nearly identical preoperative PPS values for both implants, reinforcing our finding of baseline mobility equivalence.

Postoperative results, however, favored PFNA2. In our study, the PFN group had a mean PPS of 7.5 ± 1.3 (range 5–9), while the PFNA2 group had a higher mean PPS of 8.2 ± 1.1 (range 6–10), with a statistically significant p-value of 0.021. This indicates that the PFNA2 group achieved better postoperative mobility

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outcomes. Harisankar et al. (2022) (7) similarly reported significant postoperative PPS improvement for both groups, with PFNA2 outperforming PFN. Singh et al. (2022) (9) also observed better mobility in the PFNA group. Sharma et al. (2017) (12) found final mobility scores of 7.6 for PFN and 8.2 for PFNA2, aligning with our findings. Mallya et al. (2019) (10) reported postoperative PPS values of 7.7 for PFN and 8.1 for PFNA2, while Mohan et al. (2015) (13) also concluded that PFNA2 led to superior postoperative mobility.

As for complications, our study reported no significant difference between the PFN and PFNA2 groups. However, the PFN group had a slightly higher complication rate which included wound infection, implant failure, and non-union. In contrast, the PFNA2 group had a complication rates, a trend also reported by Singh (2021) (15). Singh et al. (2022) (9) documented a 2% complication rate for PFNA2 versus 8% for PFN. Zhang et al. (2023) (5) also found lower complication rates in the PFNA group, especially regarding implant failure and non-union. Harisankar et al. (2022) (7) similarly noted fewer complications in the PFNA2 group, including reduced instances of screw cut-out and non-union. Sharma et al. (2017) (12) confirmed that the PFNA2 group experienced fewer complications while maintaining similar functional outcomes. Mallya et al. (2019) (10) also observed that both implants had a similar complication profile and comparable functional recovery.

CONCLUSION

While both PFN and PFNA2 provide satisfactory functional outcomes for patients with intertrochanteric fractures, PFNA2 demonstrates several advantages, including higher functional and mobility scores and lower complication rates. These factors make PFNA2 a preferable option, particularly for minimizing surgical risks in high-risk populations such as the elderly with osteoporotic bones.

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